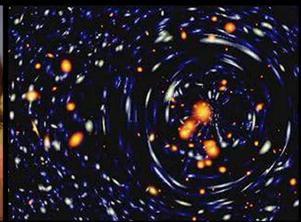


# Large Synoptic Survey Telescope

# E-News



LSST E- NEWS

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*Before you read through the fullest LSST E-News ever, take note of this late breaking news: The LSST Construction Project will hold a workshop the week of August 11 - 15, 2014 in Tucson, AZ to allow technical teams involved in building LSST to interact with each other and the broader community. Members of LSST Science Collaborations and other eventual LSST users are encouraged to organize concurrent meetings and coordinate with the Project Office to build agendas that include appropriate amounts of interaction with LSST team members. Additional information will be forthcoming but at this point we ask that you Save the Date: August 11 - 15, 2014!*

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## FROM THE DIRECTOR, STEVEN KAHN



Members of the LSST Project Team and Final Design Review Committee, December 2013.

The New Year is off to a good start, with the passage of the Omnibus Spending Bill and the subsequent signing by the President. There is language specific to LSST within the Explanatory Statement associated with the Commerce, Justice, Science and Related Agencies portion of the Bill. The Bill appropriates a healthy level of \$200M for Major Research Equipment and Facilities Construction (MREFC), sufficient to fund all projects already under construction

with the remaining funds available to the LSST construction start.

This is an important enabling step for NSF construction funding to start this year. The Bill specifically identified LSST as part of the MREFC budget, making a new start possible if put forward by NSF and approved by the National Science Board.

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On the DOE side, the healthy funding level in the Bill identified for the Office of High Energy Physics within the Office of Science makes it very likely that the LSST Camera MIE Project will receive the full funding expected from that office in 2014. This is crucial to allow us to maintain the schedule for the Project as a whole.

The entire LSST Project continues to work diligently to begin formal construction in 2014.

In December, the NSF convened a Panel of 15 members to conduct the Final Design Review for the LSST. The week-long review took place in Tucson, AZ. The Panel concluded the project team is very strong, with well-developed plans, schedules and cost estimates and declared the Project to be ready for start of construction on July 1, 2014.

The New Year also finds two new LSST committees established: the Project Science Team (PST), an internal committee which advises project leadership on critical technical issues, and the Science Advisory Committee (SAC) to improve communication both within the project and the science community served by LSST.

### **Project Science Team**

The Project Science Team (PST) serves as an operational unit, within the Project, that carries out specific scientific

performance investigations as prioritized by the Director, the Project Manager, and the Project Scientist. Its membership includes key scientists on the Project who provide specific necessary expertise. The PST provides input on critical technical decisions as the project construction proceeds. PST Members are listed on the LSST Team page.

### **Science Advisory Council**

The Science Advisory Committee (SAC), chaired by Michael Strauss, provides a formal, and two-way, connection to the external science community served by LSST. This committee takes responsibility for policy questions facing the project and also deals with technical topics of interest to both the science community and the LSST Project. The SAC will have minutes and notes which will be made available publicly. Membership of this committee is as follows: N. Brandt (PSU), H. Ferguson (STScI), C. Hirata (OSU), L. Hunter (UCSC), J. Kalirai (STScI), B. Jain (UPenn), M. Kasliwal (Carnegie), D. Kirkby (UC Irvine), R. Malhotra (UA), R. Mandelbaum (CMU), D. Minniti (U Pontificai , Chile), M. Strauss (Princeton), L. Walkowicz (Princeton), B. Willman (Haverford), and M. Wood-Vasey (U Pittsburgh). The SAC will hold its first face to face meeting in Princeton on April 7.

## **FROM THE PROJECT MANAGER, VICTOR KRABBENDAM**

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In addition to the successful completion of the Final Design Review, the LSST subsystems have remained busy and achieved the significant milestones described here:

- The Telescope and Site team has completed several early procurements of major telescope subsystems and made awards to vendors. These include the M2 Cell Assembly (ITT Exelis) and the M2 Hexapod and Camera Hexapod/Rotator system (Moog/CSA Engineering). Procurement

of the telescope mount and summit facility have started with awards expected by May. These early efforts support vendor specific final design and risk reduction activities and will enable a swift transition into construction once authorization is received.

- The M1/M3 mirror polishing effort is nearing completion, with final acceptance testing scheduled for early 2014 at the UofA SOML. The shipping/storage container

*Continued on p. 3*

From the Project Manager (Cont.)

has been fabricated and delivered. The polished mirror will be stored locally in Tucson, awaiting completion of the active mirror cell system.

- The LSST Camera team has recently issued two large Requests for Proposals (RFPs), one for the sensor elements and the other for the L1/L2 lenses. Evaluation of proposals submitted in response to the RFPs will be completed and awards for both these major procurements are expected within the first quarter of 2014.
- The Data Management team has prototyped approximately 60% of the software functional capability. Over 350,000 lines of open source c++, python have been coded, unit tested, integrated, run in production mode on LSST simulated data and data from pre-cursor surveys. The team has released three terabyte-scale datasets, including single frame measurements, point source and galaxy photometry. A significant portion of this software has been executed in parallel on up to 10k cores (TeraGrid/XSEDE and NCSA Blue Waters hardware) with highly scalable results demonstrating that the DM System will scale to the data volumes necessary to provide annual LSST data releases during operations. In the area of gigascale network design, the team is currently



The LSST M1/M3 shipping container patiently waits for its contents in a Tucson, AZ, parking lot.

testing data transfers between Chile and the US at up to 1 Gbps, a 10 Gbps link shared with DES and CTIO. Agreements in principle are in hand with key network and processing center infrastructure providers (NCSA, FIU/AmPath, REUNA).

The LSST Project Office continues to grow to support the upcoming construction effort. In Tucson there were a number of organizational changes recently, including the addition of Bo Xin as Systems Analysis Scientist and Chuck Gessner as Head of Safety. Another project-wide meeting to include the science community is being planned for August of 2014, bringing together scientists and technical teams for a week of intense interaction.

## DES/LSST WORKSHOP ANNOUNCED



LSST and the Dark Energy Survey have announced a joint workshop at Fermilab March 24-27, 2014 to share information about tools and lessons learned and to discuss future synergistic activities. The first three days of the workshop will be filled with talks on topics of broader interest;

the final day (Thursday) will be available for smaller, more focused meetings. The chairs of the Scientific Organizing Committee request that suggestions for Thursday topics and participants be emailed to them ([ivezic@astro.washington.edu](mailto:ivezic@astro.washington.edu) and [dodelson@fnal.gov](mailto:dodelson@fnal.gov)). Note also that in addition to invited talks, the SOC may accept a limited number of contributed talks.

For more information and to register please visit <http://indico.fnal.gov/event/DES-LSST>. The registration period ends March 1, 2014.



2014 Feb 7 - The University of Washington will host a campus conversation on Data Sciences initiatives on campus, including the a new 5-year partnership with UC Berkeley, NYU, the Gordon and Betty Moore Foundation, and the Alfred P. Sloan Foundation to build a distributed Data Science Environment to advance data science research and practice across all disciplines. Join University of Washington President Michael K. Young, University of Washington Provost Ana Mari Cauce, University of Washington Vice Provost for Research Mary Lidstrom, along with representatives of the Gordon and Betty Moore Foundation and the Alfred P. Sloan Foundation to learn about several major initiatives within UW's eScience Institute, which supports data-driven discovery in all fields. For more information, visit <http://escience.washington.edu/event/data-science-university-washington-campus-conversation>.

## BOY SCOUTS AND SYSTEMS ENGINEERS AGREE, BE PREPARED!

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LSST Systems Engineering Manager George Angelis.

complex, diverse technical elements into a synergistic whole. He considers the collaboration, coordination, and leadership lessons learned through scouting to be valuable supplements to his professional training and experience. All of these experiences, including 12 years working for extremely large telescope projects, prepared him for his current role with LSST, a position he began in January 2013.

George, as Systems Engineering Manager, is the chief technical leader of the LSST project. He is responsible for integrating the technical contributions of the Camera,

As a scoutmaster for many years, LSST Systems Engineering Manager George Angelis discovered that wrangling the varied interests and attention spans of 29 Boy Scouts to participate in organized outdoor activities bears much in common with integrating com-

Data Management, and Telescope and Site subsystems into an integrated system through interface design and specification, modeling, and simulations over the whole lifecycle of the project from construction to commissioning and hand-over to operations.

"LSST offers me the entire range of engineering," George said. "Individually, most elements of LSST constitute exciting engineering, but the real fascinating thing is the capability of the overall system, using essentially existing technology, to extract incredibly detailed information about the Universe."

As an example of how that applies specifically to systems engineering, George cited end-to-end integrated modeling, which was well-established for space missions and particle physics projects, but is now also standard for ground-based astronomy, in large part due to LSST's efforts.

Before joining LSST, George was Head of Systems Engineering for the Thirty Meter Telescope (TMT) project. He has also worked for the Giant Segmented Mirror Telescope, the University of Arizona's Center for Astronomical Adaptive Optics, a number of industrial

*Continued on p. 5*

*George (Cont.)*

firms, and his own startup. He earned a Master's degree in engineering physics from the Technical University of Budapest and a Ph.D. in optics and electrical engineering from the University of Arizona.

Becoming an engineer came naturally to George, "It's not a career path; it's a personality." His grandfather was an electrician, his father an electrical engineer. He spent his childhood fixing – and destroying – circuits. Even his interest in history is driven by a fascination with the unanswered questions of the inner workings of human society. It was high school where he realized he most enjoyed putting things together, things that other people can actually use.

"I love systems engineering for its duality," George said. "Its major concern is the 'big picture' of engineering a

complex machine, while it is also responsible for getting every detail of that engineering right. It is managing complexity – breaking complicated expectations down into manageable pieces and then integrating these pieces back into an intricate machine doing what it is expected to do. It is quintessential engineering, if it is done right."

In his leisure time, George enjoys reading, watching movies, a variety of outdoor activities, and spending time with his wife, four children, and two grandchildren.

"My wife and I arrived in the United States with a couple of suitcases, virtually no money, and no friends," George said. "We've managed to carve out a living doing things we also quite enjoy. But we are especially proud to have four great kids; all of them are nice, smart, well educated, and contributing members of the society."

## SMWLV SCIENCE COLLABORATION MEETS AT AAS



The Stars, Milky Way, and Local Volume (SMWLV) LSST Science Collaboration (SC) took advantage of the January 2014 AAS Meeting to schedule a Splinter Meeting. More than 30 SC members attended this meeting and made progress toward the Collaboration's goal of developing roadmaps to guide our activities for the next few years.

Formed in March 2013 by merging two existing collaborations, the SMWLV SC is currently led by Beth Willman (Spokesperson, Haverford College), Nitya Kallivayalil (Science Chair, UVA), and John Bochanski (Technical Chair, Haverford College). This large collaboration is itself composed of seven scientific sub-groups: variable stars, star clusters, Magellanic clouds, near field cosmology, the Galactic bulge, low mass stars/Solar neighborhood, Galactic structure, and ISM.

In the second half of 2013, each sub-group submitted an initial roadmap, written with the goal of identifying technical and scientific challenges that must be addressed to conduct science with LSST. The next phase of the roadmap process will be the development of a plan overcoming those challenges and identifying interesting pre-cursor science that can be done now with potential additional funding.

The motivating goals for this splinter meeting were (i) to provide attendees with information about the Project in response to technical questions and concerns raised in the Phase 1 roadmaps submitted by each of our seven sub-groups, and (ii) to begin conversations across the Collaboration that will lead to the next phase of roadmap

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writing - selecting high priority goals and outlining a pathway to achieving them. Another equally important goal of this meeting was to highlight specific pre-cursor technical and scientific investigations that are already ongoing within the Collaboration.

The splinter meeting was a success. Highlights of the meeting included impressive presentations by Will Clarkson, Knut Olsen, and Bob Blum about precursor science in the

bulge and Magellanic Clouds being done with DECam, as well as the excellent questions and discussions instigated by Collaboration members. The SMWLV SC left the meeting with the immediate action items to aggressively investigate y4 filter calibration and to develop and circulate a plan for moving onto the next phase of roadmap development.

Article written by Beth Willman and Suzanne Jacoby, bwillman@haverford.edu and sjacoby@lsst.org.

## LSST TEAM MEMBERS WRITE (AAS) BEST SELLER



Two of four co-authors, LSST Project Scientist Zeljko Ivezic (left) and LSST Simulations team member Jacob VanderPlas, stand ready to sign copies for fans of their new book at the January 2014 AAS meeting in Washington, DC.

Three LSST team members held a successful book signing event for their recently published book *Statistics, Data Mining, and Machine Learning in Astronomy, A Practical Python Guide for the Analysis of Survey Data* during the January 2014 meeting of the American Astronomical Society (AAS) in Washington, D.C. Zeljko Ivezic, Andrew Connolly, and Jacob VanderPlas collaborated with co-author Alexander Gray on the book, which provides a comprehensive and accessible introduction to the cutting-edge statistical methods needed to efficiently analyze complex

data sets from astronomical surveys such as PanSTaRRS, DES, and LSST.

Demand for the book proved impressive; all copies available at the meeting, including a supplementary overnight shipment the following day, sold out. Additional orders also were taken.

In the book, the authors present a wealth of practical analysis problems, evaluate techniques for solving them, and explain how to use various approaches for different types and sizes of data sets. For all of the applications described, the authors provide Python code and example data sets. The downloadable data sets are from contemporary astronomical surveys such as the Sloan Digital Sky Survey. The accompanying code is publicly available, well documented, and follows uniform coding standards.

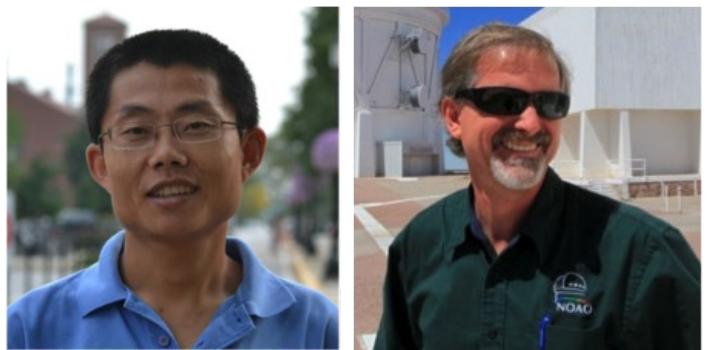
Ivezic is a professor of astronomy at the University of Washington (UW) and LSST Project Scientist. Connolly is a professor of astronomy at UW and head of the LSST Simulations team. VanderPlas is an NSF postdoctoral research fellow in astronomy and computer science at UW and a member of the LSST Simulations team. Gray is a professor of computer science at Georgia Institute of Technology. The book is part of the Princeton University Press Series in Modern Observational Astronomy.

## LSST PROJECT OFFICE GROWS BY TWO

The LSST Project Office (LSSTPO) added two new staff members in December. Bo Xin joined the Systems Engineering Team as System Analysis Scientist, and Charles (Chuck) Gessner became full-time Head of Safety. Both have previous long associations with the LSST project.

As System Analysis Scientist, Bo supports the Systems Engineering Manager and Systems Scientist with system analysis using the project's high level modeling tools (ImSim, OpSim, CalSim) as well as various other computational environments (Zemax, MatLab, Python). He will work closely with the simulations teams, subsystem project scientists, and subsystem system engineers to develop and coordinate key system level architectures, including the conceptual design of select critical components. Formerly of Purdue University, Bo previously contributed to LSST both as a science collaboration member and as an instrumental part of the team behind the design of LSST's active optics system, particularly the curvature wavefront sensor.

Chuck has a long relationship with LSST, having acted as part-time safety manager since 2007 while employed by LSST partner National Optical Astronomy Observatory (NOAO). He was instrumental in both recruiting experts to



Bo Xin (left), System Analysis Scientist, and Chuck Gessner, Head of Safety, bring their expertise as new full-time members of the LSST Project Office team.

join the LSST Safety Council and in establishing the LSST safety program he will now oversee full-time. Chuck has more than 25 years of experience providing safety expertise, risk assessment, procedure development, training, and safety program management. Before joining NOAO in 2002, he served as head of safety for Bridgestone/Firestone, Inc. and Magma Copper Company. In addition to his proficiency in program implementation, standards development, and compliance, Chuck has managed and mentored more than 40 respected safety and health professionals.

Welcome Bo and Chuck.

*Article written by Robert McKercher*

## LSSTC ADDS TWO NEW INSTITUTIONAL MEMBERS

At the close of 2013, the LSST Corporation (LSSTC) added two new institutional members, Northwestern University (NU) and University of Oxford. Northwestern's admission was approved at the Board of Directors' face-to-face meeting October 2; Oxford was admitted at the Board's December meeting. Both universities offer the expertise of leading researchers in scientific areas synergistic with LSST's mission. The additions bring LSSTC institutional

membership to 40 universities, planetaria, national observatories, national laboratories, and industry leaders.

Northwestern's Center for Interdisciplinary Exploration and Research in Astrophysics (CIERA) led NU's membership petition, which promoted the center's strong focus on astrophysical research and broad interdisciplinary involvement with a wide community of researchers. Faculty and postdoctoral fellows at CIERA work on a wide range

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## NORTHWESTERN UNIVERSITY

transits, and other solar system transients. In addition, a number of particle physics faculty members are interested in joining LSST, contributing in the area of statistics and big-data challenges.

The Oxford Physics Department led its membership petition, but members of the Engineering Department and

the Oxford e-Research Centre (OeRC) are also interested in LSST activities. Groups within Oxford Physics have made significant contributions to many of the world's leading physics facilities

through project and science teams, instrument development, construction and commissioning, and science exploitation. Oxford also offers skilled engineering staff and well-equipped mechanical and electronic workshops with state-of-the art fabrication capabilities.

of LSST-related topics: from stellar binary mergers and LIGO to transient events, AGN surveys and characterization, dense stellar dynamics, galaxy clusters and gravitational lensing, planetary

Oxford faculty members are interested in LSST's capability to elucidate the nature of dark energy. They intend to develop weak lensing analysis, including galaxy shape and photometric redshift estimation; extract dark energy parameters and test modified gravity; and cross-correlate with other probes. They are also interested in the assembly history of galaxies. Lastly, with LSST collaborators internationally, Oxford plans to develop and potentially partly host a Large Scale Survey Astronomy School to train the next generation of PhD students.

LSSTC formed in 2003 as a not-for-profit 501(c)3 Arizona corporation with four founding institutional members – The University of Arizona, The University of Washington, the Research Corporation for Science Advancement, and AURA, through its operating center, the National Optical Astronomy Observatory (NOAO). With headquarters in Tucson, Arizona, the Corporation's primary purpose is to advance research and education by collaborating in the construction and operation of the Large Synoptic Survey Telescope system. Through its stewardship of the private funding portion of the public/private partnership to build and operate LSST, the Corporation has contributed significantly to the LSST Project by facilitating early site preparation, mirror construction, and data management system development.

*Article written by Robert McKercher*

## AURA WORKFORCE AND DIVERSITY COMMITTEE MEETS AT STSCI

Members of the AURA Workforce and Diversity Committee (WDC) met in Baltimore at the Space Telescope Science Institute December 12 & 13, 2013. This AURA governance committee works to develop and maintain a positive, inclusive work environment at all AURA Centers as well as provide opportunities for underrepresented groups,

institutions, and geographic areas to contribute to AURA's mission and the overall field of astronomy. As LSST moves into construction, we're strengthening our commitment to develop a culture that promotes respect, communication, fairness, and inclusion throughout the project.

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One outcome of the WDC meeting was the submission of a proposal for a workshop at the June 2014 AAS meeting in Boston. AURA has developed expertise and toolkits for: diversity and equity in hiring practices; a positive workplace culture; family-friendly work policies; effective mentoring and professional advancement; and connections to local, diverse communities. AURA's WDC intends to share these strategies, training materials, and toolkits through a series of AAS workshops and build a community of practice among institutions with similar goals.

This proposed Summer 2014 initial workshop will focus on: (1) Using climate surveys as tools for improving the professional climate in your department, and (2) Technical tools and strategies for enabling a flexible, family friendly workplace. Workshop leaders include: Lotte Bailyn (MIT), Sheryl Bruff (STScI), and Keivan Stassun, the new Chair of the WDC.



The WDC meets twice a year face-to-face; the DAs meet more frequently via telecon. More information and resources are available on AURA's website. These resources include AURA's Guide to Best Practices for Recruitment and Selection as well as an updated brochure on Unconscious Bias.

*Article written by Suzanne Jacoby, LSST Diversity Advocate*

## LSST E-NEWS TEAM:

- Suzanne Jacoby (Editor-in-Chief)
- Robert McKercher (Staff Writer)
- Mark Newhouse (Design & Production: Web)
- Emily Acosta (Design & Production: PDF/Print)
- Additional contributors as noted

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